UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,831	04/18/2005	Seong Ho Yoon	LNK-0109	3754

23413 7590 06/05/2008
CANTOR COLBURN, LLP
20 Church Street
22nd Floor
Hartford, CT 06103

EXAMINER	
ZIMMER, ANTHONY J	
ART UNIT	PAPER NUMBER
1793	

MAIL DATE	DELIVERY MODE
06/05/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/531,831	HO YOON ET AL.	
	Examiner	Art Unit	
	ANTHONY J. ZIMMER	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 March 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 March 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 3-4 and 11-13 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant points to page 15, line 2 – page 16, line 12 of the specification for support for the amendments. Support for the limitation of preparing an "alloy of a primary metal and a secondary metal" before any reduction step is performed, as seen in amended claims 3-4 and 11-13, could not be found, though the formation of a mixed metal oxide is described.

Also, support for the limitation in amended claims 3-4 and 11-13 of "to form an alloy-catalyst" could not be found in the cited passage of the specification.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to

a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-2 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker '849.

In regard to claims 1, 2, and 9-10 In regard to claim 1, in general chemistry, it has been well known that all carbon nanostructures are composed of hexagonal carbon planes. See PTO-892: evidentiary document US5653951 column 4, lines 37-38.

BAKER '849 teaches spacing between graphite sheets of 0.335 nm – 1.1 nm. See BAKER '849 [0019]. Though the other limitations of the claims are not explicitly taught in BAKER '849, the process of making the instant product is substantially similar to the process used in BAKER '849. In particular, both processes utilize catalytic pyrolysis using a reduced bulk or particulate catalyst of iron with cobalt or nickel. See instant pages 13-15 and Baker '849 [0020]-[0024]. Thus, since the processes of preparing the nanofibers are substantially similar, the product must also be substantially similar and have substantially similar properties. See MPEP 2112.01.

[Even furthering this conclusion, many angles between the carbon planes and the length direction of the fiber and the fact that the angle depends on the catalyst used

are known in the art, and BAKER '849 shows this in Figure 1 (notice the various angles produced) and Example 6, Table VI (notice the various structures characterized by various angles in Figure 1 formed with different catalysts). Furthermore, nodes and knots including ones that periodically connect two fibers are a common defect in the formation of carbon nanostructures which necessarily involve "inter-fiber" force or Van der Walls force since carbon molecules are involved on a molecular level and Van der Walls forces are inevitable due to constant electron motion. See evidentiary documents: Figure 2 of US6156256 and Figure 5 of US6333016. There is also nothing of record that suggests the formation of an unexpected, different product from the instant process. The claimed product is a description of the product of a known process with a common defect.]

Claims 3-8 and 11-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker '849 in view of Baker '784 and Resasco '910.

In regard to claims 3-4, BAKER '849 teaches heating (reacting), in the presence of a carbon containing gas (catalytic pyrolysis), a catalyst bulk metal in powder form that had been reduced in hydrogen gas therefore forming a reduced catalyst. Though BAKER '849 does not specifically mention that hydrogen simultaneously forms very fine particles of the catalyst and reduces the catalyst, since the method steps leading to this result are the same (reducing the catalyst in hydrogen), the result produced by the method steps (forming very fine particles) would necessarily be the same. It is also specified in BAKER '849 that the catalyst particle size [after preparation] is 0.25

nanometers – 5 micrometers (a very fine particulate). See BAKER '849, [0021] – [0023].

In regard to claims 5 and 6 (which depend on claims 3 and 4, respectively), BAKER '849 teaches using iron (Fe) as a primary metal and copper or nickel as a secondary metal in proportions of iron to the other metal of from 1% - 99%. See [0020] and Example 4 in BAKER '849. BAKER '849 also teaches reacting the catalyst at temperatures of from 450°C-700°C, see [0021] and Example 1; reacting for various times including 2 hours, 2.5 hours, and 1 hour, see Examples 1-7; and hydrocarbon/hydrogen gas mixtures containing from 20%-80% hydrogen, see examples 2 and 3. BAKER '849 does teach regulating the gas flow rate, see [0030] lines 4-5, but BAKER '849 does not mention a specific gas flow rate of from 0.5-30 sccm/mg catalyst. However, it is common knowledge in the art that the gas flow rate is of critical importance during a gas phase reaction and that in order to form a product a sufficient amount of gas must be used (as it is a required reactant). The range of gas flow rates presented does not produce an unexpected result and is the result of routine optimization well within the level of ordinary skill. Therefore the range of flow rates from 0.5-30 sccm/mg catalyst does not impart a patentable distinction.

In regard to claims 7 and 8 (which depend on claims 5 and 6, respectively), BAKER '849 teaches using iron (Fe) as a primary metal and copper or nickel as a secondary metal in proportions from 1% - 99%. See [0020] and Example 4 in BAKER '849.

In regard to claims 11-13, BAKER '849 teaches heating, in the presence of a carbon containing gas (catalytic pyrolysis), a catalyst with iron (Fe) as a primary metal and copper or nickel as a secondary metal in ratios of iron to the other meal of from 1% - 99%. See [0020] and Example 4 in BAKER '849. BAKER '849 also teaches reacting the catalyst at temperatures of from 450°C-700°C, see [0021] and Example 1; reacting for various times including 2 hours, 2.5 hours, and 1 hour, see Examples 1-7; and CO/hydrogen gas mixtures containing from 20%-80% hydrogen, see examples 2 and 3. BAKER '849 does teach regulating the gas flow rate, see [0030] lines 4-5, but BAKER '849 does not mention a specific gas flow rate of from 0.5-30 sccm/mg catalyst. However, it is common knowledge in the art that the gas flow rate is of critical importance during a gas phase reaction and that in order to form a product a sufficient amount of gas must be used (as it is a required reactant). The range of gas flow rates presented does not produce an unexpected result and is the result of routine optimization well within the level of ordinary skill. Therefore the range of flow rates from 0.5-30 sccm/mg catalyst does not impart a patentable distinction.

In regard to claims 14-16 (which depend on claims 11-13 respectively),

BAKER '849 teaches using ratios of nickel to iron of 1:99 – 99:1. See BAKER '849 [0021].

(Also in regard to claims 11-16, it is established in the art to use iron in combination with other metals such as molybdenum and manganese: see US2002/131910.)

In regard to all of claims 3-8 and 11-16, BAKER '849 teaches preparing an mixed metal oxide (hereinafter referred to as an alloy) of metals used in the catalyst by co-precipitation followed by drying and calcination. Then Baker '849 teaches reducing the alloy (to form an alloy-catalyst), cooling the alloy-catalyst, and passifying the catalyst. BAKER does not teach reducing in a hydrogen/helium atmosphere at 450-550°C. However, it would have been obvious to one of ordinary skill in the art to modify BAKER '849 in view of BAKER '784 and RESASCO. RESASCO teaches that pre-reducing a metallic catalyst with heat in a hydrogen atmosphere before pyrolysis increases activity, and BAKER '784 teaches performing such a step in a 10% hydrogen/helium atmosphere. See [0054] of RESASCO and Example 1 of BAKER '784. Thus, it would have been obvious to one of ordinary skill in the art to perform such a pre-reducing step (before pyrolysis) to the metallic catalyst of BAKER '849 in order to achieve the same predictable result of increasing activity. RESASCO recognizes that the temperature of the pre-reduction step is a result effective variable affecting the activity and teaches 500°C. Furthermore, the selection of a particular temperature for a reduction process is a matter of design choice and routine optimization well within the level of ordinary skill that fails to produce an unexpected result; as temperature is known in the art (from RESASCO for example) to affect the effectiveness of the reduction process and thus the activity of the produced catalyst.

Response to Arguments

Applicant's arguments, in regard to claims 1-2 and 9-10, filed 3/27/2008 have been fully considered, but they are not persuasive.

Applicant argues that the product of BAKER '849 and the instant product are different in terms of their basic structures and physical properties of which BAKER '849 is silent. However, as indicated in the office action of 11/27/2007 and above in this office action, the instant process of producing nanofibers and the process of BAKER '849 are substantially similar and would thus produce substantially similar products. See MPEP 2112.01.

Applicant argues that the graphite sheets of BAKER'849 are parallel.

However, as can be see in Figures 1a-1e and Example 6, many different angles are produced depending on the catalyst used (including angles in the range of the claims, see the herringbone structure in Figure 1e and the graphite layers of such a herringbone structure as seen in evidentiary document US2002/0136682, Figure 21 and [0050]). Furthermore, there is no difference between the instant process and that of BAKER '849 that would affect a different product. The only notable difference is the second reduction, as seen in the newly amended process claims. However, this reduction functions only to improve the activity of the catalyst (i.e. produce more product) and does not affect the identity of the product produced.

Applicant points out that the prior art product presented in instant Figures 5 and 6 (prepared using the process of Comparative example 1 spanning pages 22-23) is different from the instantly claimed product. The exemplified product in Figures 5 and 6

was prepared using a process materially different than that of BAKER '849 (i.e. using a carbon black supported Fe/Ni catalyst (see instant Comp. Example 2) and not a bulk/particulate metal like BAKER '849), and thus such evidence is irrelevant. There is no further evidence of record to show that the instant process produces a different product than that of BAKER '849.

Applicant's arguments with respect to claims 3-8 and 11-16 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANTHONY J. ZIMMER whose telephone number is (571)270-3591. The examiner can normally be reached on Monday - Friday 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ajz

/Steven Bos/

Primary Examiner, Art Unit 1793